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Abstract

In the vast majority of experiments documenting the existence of reciprocity subjects are endowed with windfall funds. In some situations such endowments might create a so-called "house money effect". We identify two reasons why the source of endowment might matter for negative reciprocity: (1) Using earned – as opposed to windfall money – might increase the costs of negative reciprocity due to this money being in a different mental account and thus lead to less retaliation. (2) Decreasing a decision-maker's endowment consisting of earned money might be considered a stronger violation of property rights and lead to more retaliation. We test our conjectures in an experiment and find that subjects retaliate more in both cases.

Keywords: Real Effort; Experiment; House money; Reciprocity; Taking Game.

JEL Classifications: C71, C91, D03, D64

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The House Money Effect and Negative Reciprocity

1. Introduction.

Over the past two decades experimental economics research has provided ample evidence that people care not only about their own material payoffs but also that they are willing to forego significant income in order to influence the payoffs of others. Much attention has been devoted particularly to reciprocity – a tendency to react to the kind actions of others with kind responses and to the hostile actions of others with retaliation.[1] In the vast majority of laboratory experiments documenting the existence of reciprocity subjects are endowed with start up money. This endowment serves as starting capital from which subjects draw when making decisions of interest to the experimenter, potentially creating a "house money effect." The current paper explores the implications of endowing subjects with windfall gains on their observed reciprocal behavior. In particular, we study whether people are less likely to negatively reciprocate if earned money as opposed to "house money" is at stake.

Since money is fungible, why should the source of endowment matter? According to mental accounting (Thaler, 1985) different sources of income might lead to different ways of spending. If the costs of obtaining an endowment vary, people may place such endowments in different mental accounts, which might in turn lead to different choices. In particular, having to earn an endowment could increase the perceived cost of reciprocation and thus diminish its frequency and/or extent (Anderson and Putterman, 2006; Carpenter, 2007). Such a conjecture is consistent with the results of previous studies, which show that having subjects earn money in another task prior to making decisions produced more self-serving behavior both in the lab (for example, Bosman, Sutter, and van Winden, 2005; Cherry, Frykblom, and Shogren, 2002) and in the field (Clingingsmith, 2013). Since reciprocation is costly, it is possible that the experiments

1. For example Ostrom, Walker, and Gardner (1992), Fehr and Gächter (2000), Ostrom and Walker (2005); see also Camerer (2003), Cox (2013) for surveys and Rabin (1993), Dufwenberg and Kirchsteiger (2004), Falk and Fischbacher (2006), Cox, Friedman, and Gjerstad (2007) and Cox, Friedman, and Sadiraj (2008) for theoretical approaches to modeling reciprocity. Also, while not a model of reciprocity per se, inequity-aversion theory (Fehr and Schmidt, 1999) is sometimes used to explain behavior of fair-minded people who want to achieve more equitable final outcomes.

in which subjects use house money to pay for negative reciprocity overestimate the extent of reciprocal behavior. Previous research shows that generosity observed under laboratory conditions is often greater than one would observe in the field and that this might be partly due to the house money effect (Carlsson, He, and Martinsson, 2013). However, the existing literature does not allow us to conclude whether reciprocity observed in laboratory conditions is subject to the house money effect as well.

There are two reasons why the source of endowment might matter for reciprocity. The first is that if money used to pay for retaliation is earned as opposed to received from the experimenter, one might perceive the retaliation to be more costly due to this money being in a different mental account. The second reason is related to property rights. If another person decreased a decision-maker's endowment and the endowment consisted of earned money rather than house money, the decision-maker might consider it to be a stronger violation of his property rights, which in turn could trigger stronger retaliation. To tackle the issue of the house money effect we have designed an experiment in which we test whether the source of endowment influences negatively reciprocal behavior. Rather than focusing on the overall effect as most of the previous literature does, our experimental design allows us to identify the above-mentioned two reasons why earning endowments through exerting real effort might impact decisions.

Our subjects interact in a two-player *Taking Game* in which the First Mover (FM) decides whether or not to take a sum of money from the Second Mover's (SM) endowment. If the FM decides not to take, the game ends and both players keep their initial endowments. If the FM takes money from the SM, the SM can retaliate in return. Within this game we implement three treatments to separate the above-described reasons that could lead to different retaliation behavior. In the first treatment, the SM's endowment consists entirely of house money. Whatever is left after the FM's decision, the SM can use to purchase retaliation. In the second and third treatment, the SM's endowment consists of funds earned in a real-effort task as well as of house money. In one case, the FM takes the house money part of the endowment and the SM can retaliate using his earned money whereas in the other case the FM takes the earned part and the SM can retaliate using house money.

Our study builds on earlier work of three types: research on negative reciprocity, the house money effect and mental accounting. We discuss each of them in some detail in relation to our research question.

Reciprocity plays an important role in labor relationships as it has a potential to increase efficiency through enforcement of incomplete contracts (Fehr, Gächter, and Kirchsteiger, 1997). Firms value loyal workers who are committed to the goals of the firm. Loyalty means that workers take into account the interests of their employers and if employers also take into account the interests of their workers, a positive valuation of the employer's payoff can be created. The notion of loyalty therefore naturally follows from the notion of reciprocity. In the same vein, workers have many opportunities to take advantage of employers. Poor treatment of workers could lead to negatively reciprocal behavior such as low effort or even sabotage. Firms (and their managers) are well aware of potential repercussions from diminished morale and loyalty and try to circumvent them by implementing sensible strategies, such as not lowering wages following a demand shock, which is evidenced by downward wage rigidity (Bewley, 1999). A gift-exchange game has been the workhorse used to study various aspects of labor market relationships and incomplete contracts (see Charness and Kuhn, 2011 for a nice survey). While most laboratory gift-exchange experiments induce costs of effort using the house money approach, there exist some experiments (both lab and field) that involve a real-effort task (e.g. Gneezy and List, 2006; Kube, Maréchal, and Puppe, 2012) and thus circumvent the potential house money effect. However, we are unaware of any studies that would compare the behavior in a gift-exchange game with house money versus earned endowments.

Another strand of literature on (negative) reciprocity studies the impact of punishment (or sanctions) on social norms. In a seminal paper, Ostrom, Walker, and Gardner (1992) show that introducing costly punishment in a common pool resource game can overcome strong self-interest of individual appropriators and lead to a mutually efficient outcome. Fehr and Gächter (2000) explain that many cooperators have aversion against being exploited and are willing to punish free-riders in the voluntary contribution mechanism. These two papers spanned a whole new area of research dealing with various aspects of punishment (e.g. demand for punishment in Anderson and Putterman, 2006; Carpenter, 2007; fueds in Nikiforakis and Engelmann, 2011; punishment technology in Nikiforakis and Normann, 2008), anomalies such as counter-punishment (Nikiforakis, 2008) and anti-social punishment (Herrmann, Thöni, and Gächter, 2008).

Results from several extensive-form game experiments also show that subjects frequently exercise the explicit or implicit option to punish non-cooperation or unfair behavior (Abbink,

Irlenbusch, and Renner, 2000; Clark and Sefton, 2001; Cox and Deck, 2005; Cox, Sadiraj, and Sadiraj, 2008; Falk, Fehr, and Fischbacher, 2003; Güth, Schmittberger, and Schwarze, 1982). Even if punishment is costly to the subjects, those who are perceived to be unkind, offensive or reveal malevolent or selfish intentions are often punished (Bosman and van Winden, 2002; Pereira and Silva, 2006).

Experimental literature thus provides ample evidence for reciprocity under controlled laboratory conditions. As mentioned earlier, in most of these experiments participants are endowed with start up funds from the experimenter that might be treated as a windfall gain, thereby creating a house money effect, meaning that people might spend or invest such money more recklessly than they would their own. The house money effect was first evidenced by Thaler and Johnson (1990) in a lottery choice experiment in which losses were subtracted from subjects' initial endowments. Several studies point out that the observed behavior might differ if subjects receive windfall endowments as opposed to when these endowments are earned (Cherry, Frykblom, and Shogren, 2002; Clark, 2002; Cox and Hall, 2010; Harrison, 2007; Hoffman and Spitzer, 1985; Reinstein and Riener, 2012; Rutström and Williams, 2000). Having to earn the endowment creates a property right entitlement and as a result leads to a more self-regarding behavior by the person who earned it.[2] For example, Cherry, Frykblom, and Shogren (2002) run a series of dictator game experiments in which the endowments were earned through solving GMAT questions. Such design yielded significantly less generous dictator behavior than a control treatment where the dictator's endowment was randomly determined.

Cox, Servátka, and Vadovič (2013) found that earning endowments significantly affected giving and taking behavior by first movers but had an insignificant effect on second movers' reciprocal responses. First movers gave less to the second movers as well as took less from them when the endowments were earned. Clark (2002) finds no effect of house money in the voluntary contributions mechanism public goods game using unconditional nonparametric methods. Harrison (2007) shows that the same data display a significant effect when analyzing responses at the individual level and accounting for the error structure of the panel data. According to

2. This is contrasted with other participants respecting the created property rights to the endowment (Cox, Servátka, and Vadovič, 2013; Hoffman and Spitzer, 1985; Rutström and Williams, 2000). A similar pattern has been observed in experiments where the roles in a game are earned (e.g.: Erkal, Gangadharan, and Nikiforakis, 2011; Hoffman, McCabe, Shachat, and Smith, 1994).

Harrison, there were more free riders in the house money treatment than in the own money treatment, but the house money had no clear influence on the levels of positive contributions. Finally, Carlsson, He, and Martinsson (2013) used a 2x2 design combining laboratory and field experiments to examine the impact of windfall money on generosity. In both environments they found that subjects donate more when the endowment is a windfall.

The most closely related studies to ours are by Bosman and van Winden (2002) and Bosman, Sutter, and van Winden (2005) who respectively examine the impact of emotions and real effort on behavior in the Power-to-Take Game. In this two-player sequential-moves game one player (the take authority) can claim any fraction $t \in [0,1]$ of the endowment of the other player (the responder), while the latter has an opportunity to diminish the claim by choosing a destruction rate $d \in [0,1]$ and destroying his own endowment. This results in the payoff $E_{Take} + t(1-d)E_{Resp}$ for the take authority and $(1-t)(1-d)E_{Resp}$ for the responder. In Bosman and van Winden (2002) both players earn their endowments. In such environment the intensity of negative emotions experienced by the responder is positively correlated with the taking rate and the probability of endowment destruction is positively correlated to the intensity of experienced negative emotions as well as the taking rate.

In a follow up paper Bosman, Sutter, and van Winden (2005) introduce a no-effort treatment to explore whether the behavior of players is influenced by the fact that they have to earn their endowments. The results show that the behavior of take authorities does not depend on effort and that responders destroy their endowment more often and in greater amount on aggregate when effort is not involved. Also, with no effort, intermediate amounts of destruction are chosen more often whereas if effort is provided, the destruction is all or nothing. In our experiment we also study how earning of the endowments in a real effort task influences the decision making of subjects. However, our main contribution lies in decomposition of the house money effect.

From previous studies it appears that if the endowments are earned, subjects act in a more self-regarding manner. What causes such changes in behavior? Mental accounting sheds some light on the issue. According to the principle of fungibility all money is the same regardless of its origin or intended use. However, people often treat money differently depending on its source and separate their funds into mental accounts based on subjective criteria (Thaler, 1985). Mental accounting is a cognitive process by which people keep track of the flow of their money and

keep their spending under control. Thaler distinguished among three components of mental accounting. The first one captures how outcomes are perceived and experienced, and how decisions are made and subsequently evaluated. The second component involves an assignment of activities to specific accounts. Both the sources and uses of funds are labeled in real as well as in mental accounting systems. The third component of mental accounting concerns the frequency with which accounts are evaluated. Thus according to mental accounting, money in one mental account is not a perfect substitute for money in another account and it might lead to violations of the normative economic principle of fungibility. Different sources of experimental endowment might therefore have implications for subject behavior.

2. Experimental Design and Procedures.

The purpose of this experiment is to test whether negative reciprocity is subject to the house money effect. In particular, receiving an endowment from the experimenter might impact the size and/or frequency of retaliation. The existing experimental economics literature describes (at least) three methods of controlling for the house money effect. The first one was implemented for example by Clark (2002) who had his subjects bring their own money to the experiment. While this is certainly a possibility, most experimental economics laboratories, including ours, advertise that subjects will on average earn a significant amount of cash from participation. Since in our design – as described below – it is possible to suffer a loss, such method could impact the reputation and credibility of the laboratory and discourage future participation.

A second method, used by Cárdenas, De Roux, Jaramillo, and Martinez (2013), involves giving money to subjects in advance and requires them to bring it to the experiment. Such a method enables the participants to "bond" with the funds as after a period of time of being in possession they might start considering them their own. This method, however, bears a risk that subjects will not show up for the experiment or they will not bring the money with them.

A third method involves creating property right entitlements towards the initial endowments by having subjects earn them in a real-effort task as in Hoffman and Spitzer (1985) and Cherry, Frykblom, and Shogren (2002). Such procedure serves as an analogue to everyday life where people exchange their time and effort for monetary payments. While it is possible that the three methods lead to different levels of entitlement, we felt that the third method was quite natural while also being the most practical one and decided to implement it in our experiment.

In our setup, there are two reasons why the source of endowment might matter. The first reason is that if a person had to earn money he uses for retaliation, as opposed to receiving it from the experimenter, he might perceive the retaliation to be more costly due to this money being in a different mental account. He would therefore retaliate less. The second reason is that if earned money as opposed to house money is taken from a person, he might consider it to be a stronger violation of his property rights, which in turn could trigger a stronger response.

In order to separate these two effects, we have introduced a Taking Game played by two players, the First Mover and the Second Mover. The experiment consists of three treatments: HOUSE MONEY, EARNED MONEY USED, and EARNED MONEY TAKEN, implemented in an across-subjects design. The treatments differ in the source of endowment, which 1) is used for retaliating and 2) could be taken by the other player.

In the HOUSE MONEY treatment the FM receives $10 and the SM receives $18 from the experimenter as initial endowments. There is no real effort task performed by SMs. Both movers then proceed to playing the Taking Game, which is described below.

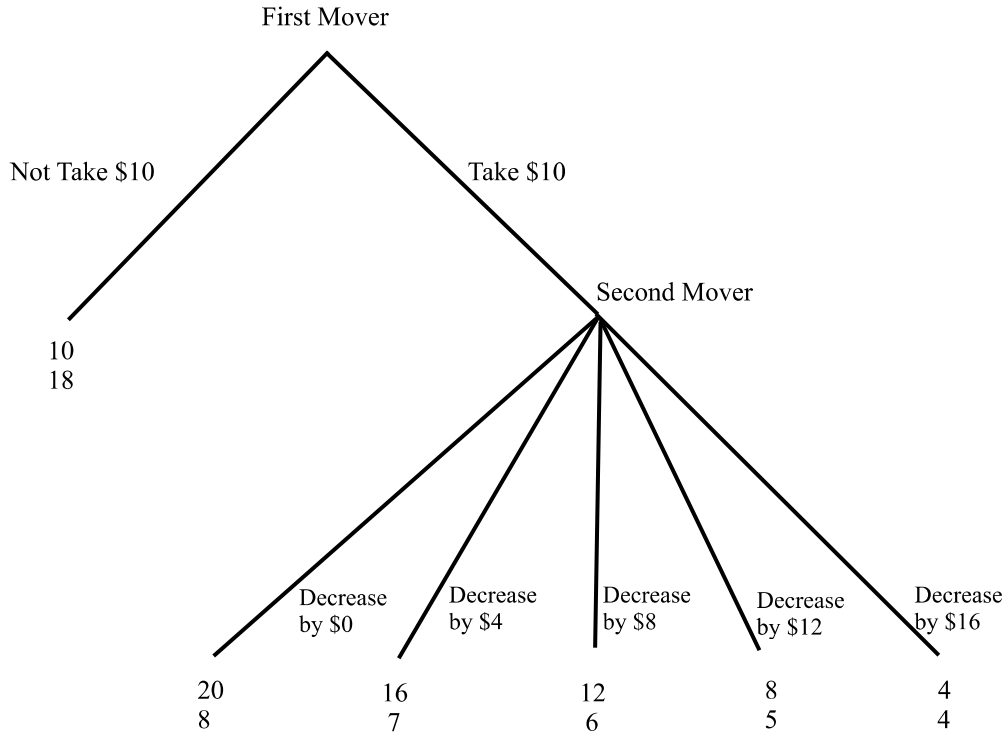
In the second and third treatment, the SM's endowment consists of funds earned in a real-effort task as well as of house money. In the EARNED MONEY USED treatment the FM as well as the SM is endowed with $10. The SM performs a real effort task, in which he can earn additional $8. The real effort task consists of cutting posters inviting students to participate in economics experiments in our laboratory. This particular task does not require any specific skills and we decided to use it because represents a meaningful activity as subjects could later see the posters on notice boards around the university campus. We asked the SMs to neatly cut the bottom part of 20 posters to create stubs that included a web page link of the database where interested students could register for experiments. For accomplishing the task, each SM earned $8. After finishing the task subjects played the Taking Game.

In the EARNED MONEY TAKEN treatment the FM can therefore take the house money part of the endowment and the SM can retaliate using his earned money. In the EARNED MONEY USED treatment this is reversed – the FM can take the earned part of the endowment and the SM can retaliate using the house money. Thus, in the EARNED MONEY TAKEN treatment, the FM is endowed with $10 and the SM with $8. On the top of that, the SM can earn additional $10 for cutting posters.

The Taking Game that was played in all three treatments is presented in Figure 1. In Stage 1 of the game the FM decides whether to *Take* or *Not Take $10* from the SM. If the FM does *Not Take $10*, this yields the FM a payoff of $10 and SM a payoff of $18. If the FM *Takes $10* from the SM, the game proceeds with Stage 2, where the SM decides whether to retaliate by decreasing the FM's payoff. For every $4 that FM's payoff has been decreased, SM's payoff will be decreased by $1. The SM can use up to $4 from his own endowment to decrease the FM's payoff up to $16. If the SM does not wish to retaliate against the FM, he can do so by choosing the "decrease by $0" option.[3]

Figure 1.

Taking Game.



3. Our Taking Game differs from Bosman, Sutter, and van Winden (2005) Power-to-Take Game in the following ways. In Taking Game the FM has only two options, i.e. to *Take $10* from the SM or *Not Take $10*, whereas in Power-to-Take Game the FM chooses a taking rate from the interval [0, 1]. The action space for the SM differs as well. While in Taking Game the SM chooses one of five available actions with destruction technology 1:4, in Power-to-Take Game he chooses a destruction rate from the [0, 1] interval. The Taking Game is more appropriate for our purposes because it allows us to separate the two above-mentioned effects that might influence the behavior of subjects when earning endowments.

For our design it was crucial that subjects recognized that the SM's endowment consisted of two parts – one that could be taken by the FM and the other that could be used to pay for retaliation. In order to highlight this we deliberately chose different amounts to represent these two parts: in all treatments \$10 could be taken and \$8 was used for retaliation. What differed was the source. The instructions were framed in a way to ensure that subjects understood which part of their total endowment was being taken and which was used for retaliation. This might aid creating two separate mental accounts. The relevant part of the instructions is presented below.

> ***Starting Balance***
> *Each person in Group A will start with a starting balance of \$10. Each person in Group B will start with a starting balance of \$18.*[4] *(*HOUSE MONEY*)*
>
> *Each person in Group A as well as in Group B will start with a starting balance of \$10. In addition to his/her starting balance each person in Group B has participated in a task, where (s)he earned \$8.* (EARNED MONEY USED)
>
> *Each person in Group A will start with a starting balance of \$10. Each person in Group B will start with a starting balance of \$8. In addition to his/her starting balance each person in Group B has participated in a task, where (s)he earned \$10.* (EARNED MONEY TAKEN)

Our design allows us to identify the reasons why the source of endowment might matter for the frequency and/or extent of retaliation. We test the following two hypotheses:

Hypothesis 1: Negative reciprocity in the EARNED MONEY USED treatment is smaller than in the HOUSE MONEY treatment.

Hypothesis 2: Negative reciprocity in the EARNED MONEY TAKEN treatment is greater than in the HOUSE MONEY treatment.

A total of 224 subjects participated in the experiment. The experimental sessions were conducted in the New Zealand Experimental Economics Laboratory (NZEEL) at the University of Canterbury. Subjects were recruited using the online database system ORSEE (Greiner, 2004).

4. Group A person = FM; Group B person = SM

Each subject only participated in a single session of the study. The experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007).

The number of subjects in a session varied from twenty to thirty-six. All sessions were run under a single-blind social distance protocol. On average, a session lasted 60 minutes including the payment and subjects earned on average 16.34 NZD.[5]

Upon entering the laboratory, subjects were randomly assigned into Group A (FMs) and Group B (SMs) by drawing a letter (A or B) from a manila envelope and asked to sit in a cubicle in an appropriate row. At the beginning of the experiment instructions (provided in the Appendix) were handed out, as well as projected onto a screen. In the EARNED MONEY USED and EARNED MONEY TAKEN treatment, Task 1 instructions were first handed out to both Group A and Group B and read aloud. Group B persons were then given scissors and 20 NZEEL posters and asked to cut them along the perforated lines. Once all Group B subjects completed the task, the posters and scissors were collected. Task 2 instructions were handed out, projected on the screen and read aloud to ensure common knowledge of the fact that Group B persons had to earn a part of their starting balance.[6]

Any questions arising were answered in private. All subjects had to answer control questions and had to get all answers right before they could proceed to the decision making part of the experiment, which was run using the strategy method (Brandts and Charness, 2011; Selten, 1967). Afterwards, subjects entered their decisions, and upon the completion of the experiment, they were asked to complete a questionnaire. Subjects were then called one by one to receive their payment in private in the payment room in the back of the laboratory.

3. Results.

3.1. First Movers' Behavior.

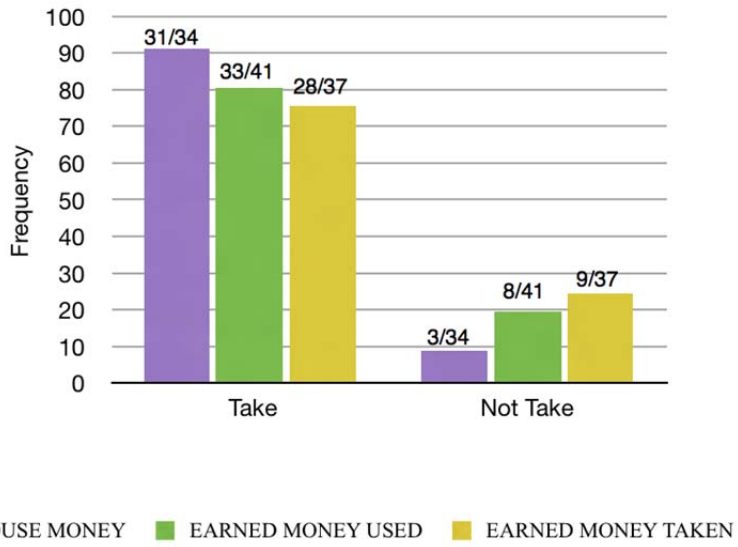
The taking behavior of FMs is indicative of whether they considered the SMs endowments to be fungible. If the FMs expected different reactions from the SMs depending on whether earned or windfall money was taken, it should lead to higher taking rates in the HOUSE MONEY and EARNED MONEY USED treatments than in the EARNED MONEY TAKEN treatment. By the

5. The minimum hourly wage in New Zealand at the time of the experiment was $13.50.
6. Since the HOUSE MONEY treatment did not involve cutting posters, Task 2 instructions were simply called Task instructions.

same logic, there should be no difference in taking behavior between the HOUSE MONEY and EARNED MONEY USED treatments. The effect of FMs' expectations could be amplified by potentially a different level of property rights – a FM might be willing to take the windfall part of SM's endowment, but respect the SM's entitlement to the earned part.

Figure 2 summarizes FMs' behavior in the experiment. The highest frequency of taking occurred in the HOUSE MONEY treatment where 31 out of 34 (91.2%) FMs took $10 from the SMs. In the EARNED MONEY USED treatment it was 33 out of 41 (80.5%) and in the EARNED MONEY TAKEN treatment 28 out of 37 (75.7%) FMs.

Figure 2.
First Movers' Behavior;



From Figure 2 it appears that the FMs took less often if the part of the SM's endowment they could lay their hands on was earned. We test whether this is indeed the case by comparing behavior in both treatments where FMs could take the windfall part of the endowment, i.e., HOUSE MONEY and EARNED MONEY USED, against the EARNED MONEY TAKEN treatment. The Fisher's exact tests reported in the second and third rows of Table 1 reveal that the frequency of taking behavior in EARNED MONEY TAKEN is statistically significantly

lower than in HOUSE MONEY (p=0.076) but not different from EARNED MONEY USED (p=0.405).

Since in HOUSE MONEY and EARNED MONEY USED treatments the FMs could take only the windfall part of the endowment, we expected there would be no statistically significant difference, which is confirmed by the result of the Fishers' test reported in the first row of Table 1 (p=0.326, two-sided). FMs' decisions thus provides mild support for the fact that subjects respected property rights created by earning money through exerting effort. Their decisions also provide a useful manipulation check. In particular, two out of three predictions regarding the FMs' behavior that were based on the source of money being taken were born out in the data (and the third prediction had "the right direction"). Based on these results it appears that FMs did not consider the earned and windfall part of SMs' endowments to be completely fungible and/or expected that SMs would act in a way as if they were not fungible.[7]

Table 1. Tests for First Movers' Behavior

	Fisher's exact test p-values
EARNED MONEY USED vs. HOUSE MONEY	0.326[a]
EARNED MONEY TAKEN vs. HOUSE MONEY	0.076
EARNED MONEY TAKEN vs. EARNED MONEY USED	0.405

a Two-sided test.

3.2. Second Movers' Behavior.

SMs' behavior is summarized in Table 2. The first column reports the number and frequency of SMs who decided to retaliate against their paired FM for taking $10. Recall that we used the strategy method and therefore have an observation on all SMs who participated in the experiment. To our surprise, the highest frequency of retaliation occurred in the EARNED MONEY USED treatment where 51.2% SMs retaliated spending on average $1.76, followed by the EARNED MONEY TAKEN (46% and $1.38) and the HOUSE MONEY (24.5% and $0.77) treatments. The last column of Table 2 presents the consequences of negative reciprocity for the FMs' earnings.

7. In EARNED MONEY TAKEN we added another manipulation check, which is discussed in the next section.

Table 2.

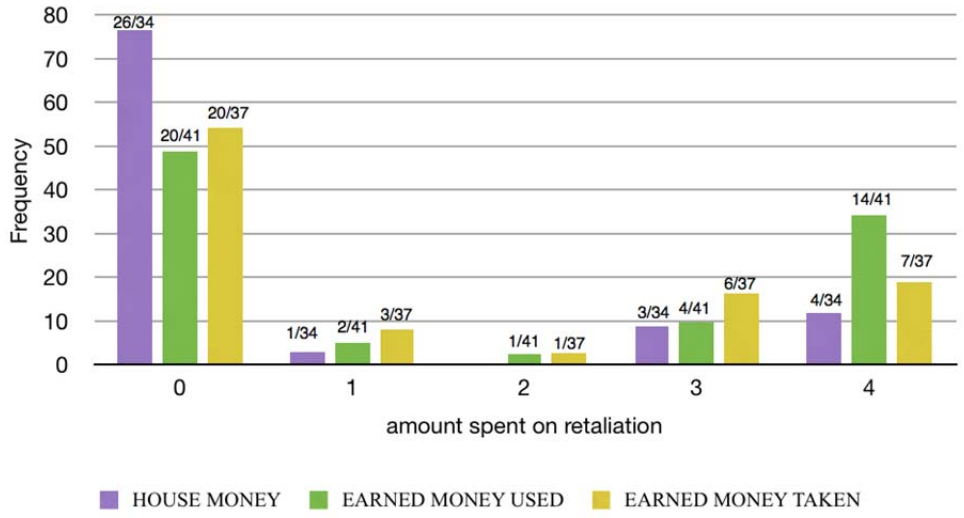
Second Movers' Behavior.

	Number of retaliating subjects	Avg. amount spent on retaliation($)	Standard deviation	SMs decreased FMs' earnings on average by ($)
HOUSE MONEY	8/34 (24.5%)	0.77	1.47	3.08
EARNED MONEY USED	21/41 (51.2%)	1.76	1.86	7.04
EARNED MONEY TAKEN	17/37 (46%)	1.38	1.69	5.52

The distribution of retaliation behavior across the three treatments is presented in Figure 3. The largest difference in SMs behavior appears to be in the $0 and $4 spent on retaliation categories. While in the HOUSE MONEY about 76.5% of SMs did not retaliate at all, in EARNED MONEY USED and EARNED MONEY TAKEN it was 48.8% and 54%, respectively. On the other hand, in EARNED MONEY USED 34.2% retaliated by the maximum amount, in EARNED MONEY TAKEN it was 18.9% and in HOUSE MONEY only 11.8%.

Figure 3.

Distribution of Second Movers' Retaliation Decisions.



Our Hypothesis 1 states that negative reciprocity in the EARNED MONEY USED treatment will be smaller than in the HOUSE MONEY treatment. This is based on a conjecture that if money used to pay for negative reciprocity is earned as opposed to received from the experimenter as a windfall gain, one might perceive the negative reciprocity to be more costly due to this money being in a different mental account. Result 1 summarizes our finding.

Result 1: The frequency and extent of negative reciprocity is ***higher*** in the EARNED MONEY USED treatment than in the HOUSE MONEY treatment.

Support for Result 1: As can be seen from Table 2, there is more negative reciprocity in EARNED MONEY USED than in HOUSE MONEY. The two-sided Fisher's exact test, reported in the first row of Table 3, supports this observation by detecting that the frequency of negative reciprocity is statistically significantly higher (p-value = 0.018) in EARNED MONEY USED than in HOUSE MONEY. The Mann-Whitney test reported in the same row, detects statistically significant difference between the two treatments in terms of the extent of negative reciprocity (p-value = 0.012), thus leading to the rejection of Hypothesis 1.

In light of our original conjecture that earning money increases the cost of negative reciprocity, the fact that SMs' retaliated more with their earned money is somewhat surprising. While the increase in negative reciprocity does not necessarily indicate that the SMs considered the two parts of their endowment to be fungible, it suggests that (negative) reciprocity and property rights are inherently related. In Section 4 we provide an ex-post interpretation of our results from the perspective of two prominent models of other-regarding behavior.

Table 3.

Tests for Second Movers' Behavior.

	Mann-Whitney test	Fisher's exact test
EARNED MONEY USED v. HOUSE MONEY	- 2.511 (0.012)	(0.018)
EARNED MONEY TAKEN v. HOUSE MONEY	-1.795 (0.073)	(0.080)
EARNED MONEY TAKEN vs. EARNED MONEY USED	0.926 (0.354)	(0.658)

Note: 2-sided tests. p-values in parentheses.

Hypothesis 2 states that negative reciprocity in the EARNED MONEY TAKEN treatment will be greater than in the HOUSE MONEY treatment. We conjectured that taking the earned part of the SMs' endowment would be considered a stronger violation of property rights than taking a windfall gain, which would then lead to stronger retaliation.

Result 2: The frequency and extent of negative reciprocity is higher in the EARNED MONEY TAKEN treatment than in the HOUSE MONEY treatment.

Support for Result 2: The Fisher's exact test, reported in the second row of Table 3 reveals that the frequency of negatively reciprocal behavior in EARNED MONEY TAKEN is statistically significantly higher than in the HOUSE MONEY (p-value = 0.080). The corresponding Mann-Whitney test detects that the extent of negative reciprocity was also higher (p-value = 0.073), thus providing support for Hypothesis 2.

Our experimental design also allows for comparison of negative reciprocity in the EARNED MONEY USED treatment with that in the EARNED MONEY TAKEN treatment. By combining Hypothesis 1 and Hypothesis 2 together, we expected to see more negative reciprocity in EARNED MONEY TAKEN than in EARNED MONEY USED.

Result 3: There is no statistical difference in negative reciprocity between the EARNED MONEY USED treatment and the EARNED MONEY TAKEN treatment.

Support for Result 3: The Fisher's exact test reported in the third row of Table 3 detects no difference in the frequency of SMs' negatively reciprocal behavior between these two treatments (p=0.658). The corresponding Mann-Whitney detects no difference in the extent of negative reciprocity (p-value = 0.354).

The fact that SMs retaliated more in both EARNED MONEY USED and EARNED MONEY TAKEN treatments than in HOUSE MONEY tells us that property right entitlements might lead to a stronger negatively reciprocal response. Do, however, subjects distinguish between house money and money earned in the real effort task? To get at this issue, in the EARNED MONEY TAKEN treatment, which was the last treatment we ran, we added two questions about subjects'

perception about the source of SMs' endowment into the post-experiment questionnaire. In particular, we asked our subjects the following questions.

The FMs who took $10:

- *The money that you took from the Group B person was earned/not earned by them?*
- *Why did you decide to take $10 from the Group B person?*

The FMs who did not take $10:

- *The money that you could have taken but didn't from the Group B person was earned/not earned by them.*
- *Why did you decide not to take $10 from the Group B person?*

The SMs from whom $10 was taken:

- *The money that Group A person took from you was earned/not earned by you.*
- *Why do you think the Group A person took $10 from you?*

The SMs from whom $10 was not taken:

- *The money that the Group A person could have but didn't take from you was earned/not earned by you.*
- *Why do you think the Group A person didn't take $10 from you?*

According to answers provided in the questionnaire, 31 out of 37 (83.8%) FMs and 32 out of 37 (86.5%) SMs perceived the money taken as earned. This suggests that the remaining 6 FMs and 5 SMs were either confused or considered the two parts of the initial endowment to be fungible.[8] Although this questionnaire data is not a direct evidence that subjects placed their house money and earned money in two different mental accounts which would then influence their decisions in the experiment, it serves as a useful manipulation check showing that subjects recognized different sources of SMs' endowments.

8. The findings presented in Subsection 3.2 are robust to removing these subjects from the statistical analysis. The results are available from the authors upon request.

3.3. Comparison with Power-to-Take Game.

Our results stand in contrast with the findings of Bosman, Sutter, and van Winden (2005) who observe that (i) the taking rate of authorities does not depend on effort and (ii) the responders destroy their endowment more often and in greater amount when effort is not involved. We find the incidence of taking to be lower in the EARNED MONEY TAKEN than in the HOUSE MONEY treatment. Furthermore, in Bosman, Sutter, and van Winden (2005) negative reciprocity is higher in the no-effort treatment than in the effort treatment whereas we find the negative reciprocity to be higher in the effort treatments.

While both games allow the FM to appropriate a part of SM's endowment and the SM to retaliate, there exist significant differences in the structure of the two games (described in footnote 3) and experimental procedures that could have contributed to different behavior. For example, different retaliation technologies combined with different action spaces could have resulted in varying strength of incentives between the two experiments. Also the fact that in our experiment only SMs exerted real effort by cutting posters whereas in Bosman, Sutter, and van Winden's experiment both types of players had to earn their endowment by solving two-task optimization problems could have contributed to respecting property rights by our FMs and a more aggressive retaliation by our SMs. Finally, subject pool differences (Dutch versus New Zealand students) are always a possibility.

3.4. Ex-Post Interpretation of Data

From the perspective of the existing models of reciprocity (Cox, Friedman, and Gjerstad, 2007; Cox, Friedman, and Sadiraj, 2008; Dufwenberg and Kirchsteiger, 2004; Falk and Fischbacher, 2006; Rabin, 1993) and unconditional distributional preferences (Bolton, 1991; Bolton and Ockenfels, 2000; Charness and Rabin, 2002; Cox and Sadiraj, 2007; Fehr and Schmidt, 1999) our three treatments are isomorphic and the only difference between them is theoretically irrelevant source of endowment. The distinctions implied by our design, however, are central to understanding reciprocal preferences.

Even though the models do not predict changes in behavior, we find it useful to evaluate the data using two prominent models of other-regarding behavior in order to shed some light on our surprising result that subjects retaliate more with earned money than with house money and to think about a way in which the models could be enriched to account for our results. We begin with the theory of revealed altruism by Cox, Friedman, and Sadiraj (2008). The theory includes a

partial ordering of opportunity sets, a partial ordering of preferences, and two axioms about reciprocity. The partial ordering of opportunity sets is given as follows. Let *s* denote SM's money payoff and let *f* denote FM's money payoff. Let s_H^* denote SM's maximum money payoff in opportunity set H and let f_H^* denote FM's maximum money payoff in opportunity set H. Opportunity set G is "more generous than" opportunity set F if: (a) $s_G^* - s_F^* \geq 0$ and (b) $s_G^* - s_F^* \geq f_G^* - f_F^*$ Our three treatments include the same opportunity sets for the SM. Let $F = \{(10,18)\}$ denote SM's opportunity set if the FM chooses Not (to) Take and $G = \{(20,8),(16,7),(12,6),(8,5),(4,4)\}$ denote SM's opportunity set if the FM chooses to Take. According to the above definition, opportunity set *G* is more generous for the SM than opportunity set F in all three treatments.

The partial ordering of preferences is defined as follows. SM's willingness to pay to increase FM's material payoff can depend on the absolute and relative amounts of their respective payoffs. In the case where marginal utilities are well-defined, SM's willingness to pay is given as follows: $WTP(s,f) = u_f(s,f)/u_s(s,f)$. Two different preference orderings, A and B, over allocations of material payoffs might represent the preferences of two different agents or the preferences of the same agent in two different situations. For a given domain D, preference ordering A is "more altruistic than" preference ordering B if $WTP_A(s,f) \geq WTP_B(s,f)$ for all $(s,f) \in D$.

Revealed altruism postulates that an individual's preferences can become more or less altruistic depending on the choices of another agent. Axiom R (for reciprocity), states that if a FM provides a more (less) generous opportunity set to the SM then SM's preferences will become more (less) altruistic towards the FM. Our results thus suggest that when the SM earned a part of his endowment it increased his willingness to pay to decrease the FM's payoff if the FM chose to Take compared to the situation when the SM's endowment was a windfall gain.

A significant portion of experimental papers dealing with negative reciprocity and punishment try to explain observed behavior using inequality aversion.[9] A few outcome-based models of other-regarding preferences posit that people dislike unequal payoffs and may lower

9. Technically speaking, inequality aversion is a special case of Cox, Friedman, and Sadiraj (2008) revealed altruism where the SM cares only about the distribution of material payoffs.

their material payoffs to lessen the disparity. Bolton (1991) suggests that people only care about relative payoffs when they are at a relative disadvantage while Bolton and Ockenfels (2000) assume that people have a symmetric dislike for inequity. Fehr and Schmidt (1999) develop the notion of self-centered inequality aversion, in which one dislikes all inequality but cares more about it when at a relative payoff disadvantage. Inequality aversion means that people resist unequal outcomes; i.e. they are willing to give up some material payoff to move in the direction of more equality. According to Fehr and Schmidt inequity model, subjects who dislike unequal outcomes experience disutility from inequality if they are worse off in material terms than the other players in the experiment. However, they also experience disutility when they are better off.

In Fehr and Schmidt (1999) model the utility function for player *i* is defined as follows:

$$U_i = x_i - \alpha_i \max\left\{x_j - x_i, 0\right\} - \beta_i \max\left\{x_i - x_j, 0\right\}, \text{ where } i \neq j$$

In our experiment, it is not possible for a SM to get a higher payoff than the FM, so we take into consideration only the disadvantageous part of the utility function: $U_i = x_i - \alpha_i \max\left\{x_j - x_i, 0\right\}$. Based on this specification, we calculate the cut-off alpha necessary for subjects to display negative reciprocity to be 1/3. By having to earn a part of their endowment, SMs' alpha increased, meaning they started to care more about being in a disadvantageous position. This lead to more subjects having $\alpha > 1/3$ in EARNED MONEY USED and EARNED MONEY TAKEN than in HOUSE MONEY, which in turn lead to more retaliation in the former two treatments. If we therefore assume that retaliation in our experiment is driven by inequality aversion, our results suggest that the aversion increases when (a part of) decision maker's endowment was earned by exerting real effort.

4. Discussion.

This paper experimentally investigates the extent of reciprocal reaction to unkind behavior when a part of the initial endowment is being earned by performing a real effort task. We compare subjects' behavior in three treatments that differ in the source of endowment being taken by another player and/or used for negative reciprocity. The treatments are nested in a Taking Game in which the FM has an opportunity to take $10 from the SM for which the SM can retaliate.

Based on Thaler's (1985) mental accounting, we conjecture that subjects place their earned money and house money in two different mental accounts and as a result will retaliate less using their earned money because it increases the costs of negative reciprocity. Similarly, if it is earned money that is taken from subjects, we conjecture that they will retaliate more because of the violation of their property rights, which are stronger for the account that stores earned funds. While we find support for the latter conjecture, we also find that subjects actually retaliate more with their earned money than with house money. Although we provide auxiliary evidence that subjects recognized the difference between earned money and house money, this does not necessarily mean that they were using different mental accounts for the two. This exploration is left for future research.

Our results point out that laboratory experiments employing windfall endowments do not seem to overestimate (negatively) reciprocal behavior. The observation that earned endowments lead to a stronger reciprocal response, however, raises an interesting question of how (various levels of) property rights interact with reciprocity. The current paper as well as Cox and Hall (2010) point out that stronger property rights might increase the intensity of reciprocation, however, Cox, Servátka, and Vadovič (2013) do not find evidence of earned endowments on subject responses. It is therefore likely that the initial conditions (for example, modeled by the notion of status quo in the above mentioned Cox, Friedman, and Sadiraj, 2008) as well as the process how they originate are likely to have implications for reciprocal behavior.

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Appendix 1. HOUSE MONEY Treatment Instructions

INSTRUCTIONS

No Talking Allowed
Now that the experiment has begun, we ask that you do not talk. If you have a question after we finish reading the instructions, please raise your hand and the experimenter will approach you and answer your question in private.

Anonymity
You have been randomly divided into two groups, called Group A and Group B. Each person in Group A will be randomly paired with a person in Group B. No one will learn the identity of the person (s)he is paired with.

Structure of the Experiment
Each Group A and Group B person will make only one decision in this experiment. The experiment is computerized. If you have any trouble entering your decisions on the computer, please raise your hand to alert the experimenter who will assist you.

Starting Balance
Each person in Group A will start with a starting balance of $10. Each person in Group B will start with a starting balance of $18.

Group A Decision Task
Each Group A person decides whether or not to take $10 from the starting balance of the paired Group B person.

If the Group A person decides **not to take $10** then the Group A person receives final earnings of $10 and the Group B person receives final earnings of $18.

If the Group A person decides **to take $10**, the paired Group B person then decides whether to decrease the Group A person's earnings. Group B person's decision is explained below.

Group B Decision Task
If the Group A person has decided to take $10 from the starting balance of the Group B person, the Group B person can decrease the Group A person's final earnings. Decreasing a Group A person's final earnings by $4 costs Group B person $1 which will be subtracted from his/her remaining $8. The following table shows five possible decisions that are available to a Group B person and the resulting final earnings for the pair.

	Group B person decides to decrease				
	Group A person's earnings by $0	**Group A person's earnings by $4**	**Group A person's earnings by $8**	**Group A person's earnings by $12**	**Group A person's earnings by $16**
Group A person's final earnings	**$20**	**$16**	**$12**	**$8**	**$4**
Group B person's final earnings	**$8**	**$7**	**$6**	**$5**	**$4**

Note that the decision by the Group B person will only be relevant if the Group A person chose to take $10 from Group B person.

Payment of Experiment Earnings

All participants are asked to sit patiently until the end of the experiment. Once all Group B persons have made their decisions, you will be presented with a summary screen of your earnings. Click OK after you have seen this screen, so other participants cannot see your decisions. You will then be prompted to complete a questionnaire. After the questionnaire, you will be asked one by one to approach the payment room at the back of the lab for the payment of your earnings. All the money will be paid to you in cash at the end of the experiment. Because your decision is private, we ask that you do not tell anyone your decision or your earnings either during or after the experiment. We also ask you to not gather near the lab after you receive your payment.

Are there any questions?

Appendix 2. EARNED MONEY USED Treatment Instructions

TASK 1 INSTRUCTIONS

No Talking Allowed
Now that the experiment has begun, we ask that you do not talk. If you have a question after we finish reading the instructions, please raise your hand and the experimenter will approach you and answer your question in private.

You have been randomly divided into two groups, called Group A and Group B. Each person in Group B will now have the opportunity to earn money.

Group B Task
In today's experiment each person in Group B will participate in a task, where (s)he will get a chance to earn $8. Each participant will be given 20 posters promoting NZEEL experiments. These posters need to be cut in a way that people passing by can take a stub with web page link where they can register for the experiments. The posters will then be placed in different parts of the university in order to recruit subjects for future experiments. Please cut the posters individually so that the stubs are neat. You will be paid only if you finish cutting all 20 posters that will be given to you.

Group A Has No Task
While Group B persons perform their task, we ask all Group A persons to wait patiently and quietly. Please do not use the computer in front of you as it is set up for the experiment.

Task 2 of the experiment will follow shortly.

TASK 2 INSTRUCTIONS

Anonymity
In Task 2 each person in Group A will be randomly paired with a person in Group B. No one will learn the identity of the person (s)he is paired with.

Structure of Task 2
Each Group A and Group B person will make only one decision in Task 2 which is the final part of the experiment. That is, after Task 2 there are no more tasks.

Task 2 is computerized. If you have any trouble entering your decisions on the computer, please raise your hand to alert the experimenter who will assist you.

Starting Balance
Each person in Group A as well as in Group B will start with a starting balance of $10. In addition to his/her starting balance each person in Group B has participated in a task, where (s)he earned $8.

Group A Decision Task

Each Group A person decides whether or not to take the $10 starting balance from the paired Group B person.

If the Group A person decides **not to take $10** then the Group A person receives final earnings of $10 and the Group B person receives final earnings of $18 ($10 starting balance and $8 from Task 1).

If the Group A person decides **to take $10**, the paired Group B person then decides whether to decrease the Group A person's earnings. Group B person's decision is explained below.

Group B Decision Task

If the Group A person has decided to take the $10 starting balance from Group B person, the Group B person can decrease the Group A person's final earnings using the money (s)he has earned in the Task 1. Decreasing a Group A person's final earnings by $4 costs Group B person $1 which will be subtracted from his/her Task 1 earnings of $8. The following table shows five possible decisions that are available to a Group B person and the resulting final earnings for the pair.

	Group B person decides to decrease				
	Group A person's earnings by $0	**Group A person's earnings by $4**	**Group A person's earnings by $8**	**Group A person's earnings by $12**	**Group A person's earnings by $16**
Group A person's final earnings	**$20**	**$16**	**$12**	**$8**	**$4**
Group B person's final earnings	**$8**	**$7**	**$6**	**$5**	**$4**

Note that the decision by the Group B person will only be relevant if the Group A person chose to take $10 from Group B person.

Payment of Experiment Earnings

All participants are asked to sit patiently until the end of the experiment. Once all Group B persons have made their decisions, you will be presented with a summary screen of your earnings. Click OK after you have seen this screen, so other participants cannot see your decisions. You will then be prompted to complete a questionnaire. After the questionnaire, you

will be asked one by one to approach the payment room at the back of the lab for the payment of your earnings. All the money will be paid to you in cash at the end of the experiment. Because your decision is private, we ask that you do not tell anyone your decision or your earnings either during or after the experiment. We also ask you to not gather near the lab after you receive your payment.

Are there any questions?

Appendix 3. EARNED MONEY TAKEN Instructions

TASK 1 INSTRUCTIONS

No Talking Allowed
Now that the experiment has begun, we ask that you do not talk. If you have a question after we finish reading the instructions, please raise your hand and the experimenter will approach you and answer your question in private.

You have been randomly divided into two groups, called Group A and Group B. Each person in Group B will now have the opportunity to earn money.

Group B Task
In today's experiment each person in Group B will participate in a task, where (s)he will get a chance to earn $10. Each participant will be given 20 posters promoting NZEEL experiments. These posters need to be cut in a way that people passing by can take a stub with web page link where they can register for the experiments. The posters will then be placed in different parts of the university in order to recruit subjects for future experiments. Please cut the posters individually so that the stubs are neat. You will be paid only if you finish cutting all 20 posters that will be given to you.

Group A Has No Task
While Group B persons perform their task, we ask all Group A persons to wait patiently and quietly. Please do not use the computer in front of you as it is set up for the experiment.

Task 2 of the experiment will follow shortly.

TASK 2 INSTRUCTIONS

Anonymity
In Task 2 each person in Group A will be randomly paired with a person in Group B. No one will learn the identity of the person (s)he is paired with.

Structure of Task 2
Each Group A and Group B person will make only one decision in Task 2, which is the final part of the experiment. That is, after Task 2 there are no more tasks.

Task 2 is computerized. If you have any trouble entering your decisions on the computer, please raise your hand to alert the experimenter who will assist you.

Starting Balance
Each person in Group A will start with a starting balance of $10. Each person in Group B will start with a starting balance of $8. In addition to his/her starting balance each person in Group B has participated in a task, where (s)he earned $10.

Group A Decision Task
Each Group A person decides whether or not to take the $10 which Group B person has earned in the previous task.

If the Group A person decides **not to take $10** then the Group A person receives final earnings of $10 and the Group B person receives final earnings of $18 ($8 starting balance and $10 from Task 1).

If the Group A person decides **to take $10**, the paired Group B person then decides whether to decrease the Group A person's earnings. Group B person's decision is explained below.

Group B Decision Task
If the Group A person has decided to take the earned $10 from Group B person, the Group B person can decrease the Group A person's final earnings using the money from the starting balance. Decreasing a Group A person's final earnings by $4 costs Group B person $1 which will be subtracted from his/her starting balance of $8. The following table shows five possible decisions that are available to a Group B person and the resulting final earnings for the pair.

	Group B person decides to decrease				
	Group A person's earnings by $0	**Group A person's earnings by $4**	**Group A person's earnings by $8**	**Group A person's earnings by $12**	**Group A person's earnings by $16**
Group A person's final earnings	**$20**	**$16**	**$12**	**$8**	**$4**
Group B person's final earnings	**$8**	**$7**	**$6**	**$5**	**$4**

Note that the decision by the Group B person will only be relevant if the Group A person chose to take $10 from Group B person.

Payment of Experiment Earnings

All participants are asked to sit patiently until the end of the experiment. Once all Group B persons have made their decisions, you will be presented with a summary screen of your earnings. Click OK after you have seen this screen, so other participants cannot see your decisions. You will then be prompted to complete a questionnaire. After the questionnaire, you will be asked one by one to approach the payment room at the back of the lab for the payment of your earnings. All the money will be paid to you in cash at the end of the experiment. Because your decision is private, we ask that you do not tell anyone your decision or your earnings either during or after the experiment. We also ask you to not gather near the lab after you receive your payment.

Are there any questions?